ABSTRACT
Catalysts are responsible for the production of over 60% of all chemicals and are used in some 90% of all chemical processes worldwide. Heterogeneous catalysts enable many chemical transformations of fossil resources (natural gas, methane, liquid petroleum, coal, etc.) into useful products. Normally, heterogeneous catalysts consist of small metal particles dispersed on a high surface area porous oxide support. Recently, atomic layer deposition (ALD) has been used to prepare highly active, highly dispersed metal nanoparticles. ALD is a thin film growth technique based on sequential, self-limiting surface chemical reactions, and has focused principally on the formation of thin film oxides with precise atomic layer control. Molecular layer deposition (MLD), which is similar to ALD, can be utilized to deposit pure polymer films or hybrid organic/inorganic polymer films using suitable precursors. Highly porous metal oxide films with well-defined porous structures and precisely controlled thickness down to several angstroms can be prepared from dense organic/inorganic hybrid metal alkoxide films grown by MLD. These ultra-thin films can be used for catalyst encapsulation. In this presentation, I will introduce ALD/MLD chemistry, metal and bimetallic nanoparticles prepared by ALD, and examples of nanostructured catalysts prepared by ALD/MLD, such as thermally stable size-selective catalysts.

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Dr. Xinhua Liang is an associate professor in the Department of Chemical and Biochemical Engineering at Missouri University of Science and Technology. He joined the department as an assistant professor in January 2012. He attended the Chemical Engineering program at Tianjin University, earning his B.S. in June 2001 and M.S. in June 2003. He received his Ph.D. in Chemical Engineering from the University of Colorado at Boulder in December 2008 and had three years’ postdoctoral training there. Dr. Liang’s research interests are in the areas of thin film growth on particles by atomic/molecular layer deposition (ALD/MLD), and applying this thin film coating technology to a broad range of energy and environmental materials research, such as nanostructured catalytic materials, storage batteries, solid oxide fuel cells, and nanostructured materials for gas and liquid separation. He has published more than 90 peer-reviewed papers in key areas of surface functionalization and applications.